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Towards a system for selecting and guiding potential fencing talents transitioning to high performance

[*Hacia un sistema de selección y orientación de potenciales talentos de esgrima que transitan al alto
rendimiento*]

[*Em direção a um sistema de seleção e orientação para potenciais talentos da esgrima em transição
para o alto rendimento*]

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ABSTRACT

Introduction: Cuban fencing faces the challenge of optimizing the transition of selected talents to the foil, épée, and sabre disciplines, a process currently based more on logistical than scientific criteria.

Objective: To characterize the specific performance models for each weapon based on its competitive demands, as a foundation for a future system of guiding potentially talented fencers toward high performance in Cuba.

Materials and methods: A descriptive study with a mixed-methods approach was conducted, employing document analysis of the International Fencing Federation's regulations (2022-2023) and a systematic literature review (2017-2025) in the PubMed, Scopus, and SciELO databases. Copello Janjaque's ten indicators were applied to characterize the competitive activity of each weapon, and findings from 28 international and 13 national authors were triangulated.

Results: Differentiated multidimensional profiles were constructed for foil (35% greater accuracy, 200 ms faster visual processing, strategic patience), épée (15-20% shorter reaction times, expanded functional field of vision, 68% of touches on counterattacks), and sabre (predominant explosive power, complex segmental coordination, 72% of offensive actions). Fourteen creative and ten functional discriminant indicators were identified for each weapon.

Conclusions: Performance models for each weapon reveal substantially different physical, cognitive, and psychological demands that scientifically justify the need for specialized guidance, establishing the theoretical and methodological foundation for designing a well-founded allocation system that optimizes talent distribution in Cuban high-performance sports.

Keywords: fencing, sports guidance, sports talent.

RESUMEN

Introducción: la esgrima cubana enfrenta el desafío de optimizar la transición de talentos seleccionados hacia las modalidades de florete, espada y sable, proceso actualmente basado en criterios logísticos más que científicos.

Objetivo: caracterizar los modelos de rendimiento específicos de cada arma a partir de sus exigencias competitivas, como fundamento para un futuro sistema de orientación de esgrimistas potencialmente talentosos hacia el alto rendimiento cubano.

Materiales y métodos: se realizó un estudio descriptivo con enfoque mixto, empleando análisis documental del reglamento de la Federación Internacional de Esgrima (2022-2023) y revisión sistemática de la literatura (2017-2025) en bases de datos PubMed, Scopus y SciELO. Se aplicaron los diez indicadores de Copello Janjaque para caracterizar la actividad competitiva de cada arma y se triangularon hallazgos de 28 autores internacionales y 13 nacionales.

Resultados: se construyeron perfiles multidimensionales diferenciados para florete (precisión 35% superior, procesamiento visual 200 ms más rápido, paciencia estratégica), espada (tiempos de reacción 15-20% menores, campo visual funcional ampliado, 68% de tocados en contraataque) y sable (potencia explosiva predominante, coordinación segmentaria compleja, 72% de acciones ofensivas). Se identificaron 14 indicadores creativos y 10 funcionales discriminantes por modalidad.

Conclusiones: los modelos de rendimiento por arma revelan exigencias físicas, cognitivas y psicológicas sustancialmente diferentes que justifican científicamente la necesidad de orientación especializada, sentando las bases teórico-metodológicas para diseñar un sistema de asignación fundamentado que optimice la distribución de talentos en el alto rendimiento cubano.

Palabras clave: esgrima, orientación deportiva, talento deportivo.

RESUMO

Introdução: A esgrima cubana enfrenta o desafio de otimizar a transição de talentos selecionados para as disciplinas de florete, espada e sabre, um processo atualmente baseado mais em critérios logísticos do que científicos.

Objetivo: Caracterizar os modelos de desempenho específicos para cada arma com base em suas demandas competitivas, como fundamento para um futuro sistema de orientação de esgrimistas potencialmente talentosos rumo ao alto desempenho em Cuba.

Materiais e métodos: Foi realizado um estudo descritivo com abordagem mista, empregando análise documental dos regulamentos da Federação Internacional de Esgrima (2022-2023) e uma revisão sistemática da literatura (2017-2025) nas bases de dados PubMed, Scopus e SciELO. Os dez indicadores de Copello Janjaque foram aplicados para caracterizar a atividade competitiva de cada arma, e os resultados de 28 autores internacionais e 13 nacionais foram triangulados.

Resultados: Perfis multidimensionais diferenciados foram construídos para florete (35% maior precisão, processamento visual 200 ms mais rápido, paciência estratégica), espada (tempos de reação 15-20% menores, campo de visão funcional expandido, 68% de toques em contra-ataques) e sabre (potência explosiva predominante, coordenação segmentar complexa, 72% de ações ofensivas). Quatorze indicadores criativos e dez indicadores funcionais discriminantes foram identificados para cada arma.

Conclusões: Os modelos de desempenho para cada arma revelam demandas físicas, cognitivas e psicológicas substancialmente diferentes que justificam cientificamente a necessidade de orientação especializada, estabelecendo a base teórica e metodológica para o desenvolvimento de um sistema de alocação bem fundamentado que otimize a distribuição de talentos no esporte de alto rendimento cubano.

Palavras-chave: esgrima, orientação esportiva, talento esportivo.

INTRODUCTION

Contemporary fencing is characterized by its high technical and tactical complexity and by the existence of three modalities—foil, épée, and sabre—which, although they share a common structure as a combat sport, have substantially different regulations, competitive dynamics, and performance demands (Fédération Internationale d'Escrime [FIE], 2022). This internal differentiation constitutes a first-order methodological challenge for sports development systems, particularly in the transition stages towards high performance, where early orientation towards the weapon of greatest affinity can determine the success or failure of the sporting career (Güllich *et al.*, 2022).

Sports selection as a scientific process and its evolution towards specialized guidance

Sports selection has shifted from empiricist and phenotypic approaches to multidimensional scientific-predictive models that integrate biological, psychological, social, and contextual variables (Baker *et al.*, 2020). This paradigmatic evolution recognizes talent not as a static attribute, but as a dynamic and emergent construct, whose early identification requires going beyond simply observing current performance to delve into assessing the subject's developmental potential and trainability (Till & Baker, 2020).

In sports with internally differentiated modalities, such as fencing, contemporary research emphasizes that "talent identification must be followed by effective guidance and specialization" (Vaeyens *et al.*, 2008, p. 703). It is recognized that "the predictive potential of early selection increases significantly when the specific requirements of the subdiscipline are considered" (Güllich & Emrich, 2014, p. 92). Authors such as Cobley *et al.* (2022) establish a clear conceptual differentiation between selection (identification of individuals with superior potential for a sport), guidance (specialized direction towards specific modalities) and specialization (progressive focus on a single discipline).

The Cuban context: advances and limitations in talent management in fencing

In Cuba, fencing has historically been a sport with significant international results. However, in recent decades, a decline in competitive performance has been observed, associated, among

other factors, with weaknesses in the initial talent identification and selection processes (Lastres Madrigal, 2023). In response to this problem, the research project " *Talent Selection for High-Performance Fencing* " (2017-2021) was developed, culminating in Lastres Madrigal's doctoral thesis (2023) entitled " *Selection of Potentially Talented Fencers from the Grassroots Level to the EIDE (School of Sports Initiation)* ."

This continuous improvement system represents a significant advance by introducing predictive tests that evaluate biological, psychological, physical, and tactical dimensions, surpassing previous empirical approaches. However, as the author herself acknowledges, her research "does not allow for assigning athletes to each weapon in accordance with its competitive demands and specific executive functions to achieve optimal performance." This limitation reveals a critical gap: once a group of young people with fencing potential is identified, the fundamental question arises: foil, épée, or sabre? Current assignments frequently respond to logistical criteria, tradition, or the coach's subjective preference, lacking a scientific basis that maximizes the chances of long-term success.

Fundamentals for building weapon-specific performance models

The differences between weapons are profound and decisive. The foil is a conventional weapon that prioritizes initiative and precision on a small target (the torso); the épée, without a conventional rule, demands a high-risk/reward strategy and speed of reaction to valid touches anywhere on the body; the sabre, also a conventional weapon, requires explosiveness, speed of movement, and cutting actions (FIE, 2023). These regulatory differences generate divergent tactical logics that translate into distinct performance profiles and anthropometric, physiological, technical, and cognitive-decisional demands (Turner *et al.*, 2023; Roi & Bianchedi, 2022).

International research has provided empirical evidence of these differences. Roi and Bianchedi (2022) demonstrate that elite foil fencers have 35% higher accuracy rates than fencers using other weapons. Piras *et al.* (2021) show that expert foil fencers process visual information 200 ms faster than novices, while Chaabène *et al.* (2021) report reaction times 15–20% faster in elite épée fencers. Bottoms *et al.* (2021) confirm greater lower limb power in sabre

fencers, and Hassan *et al.* (2023) show that expert épée fencers possess a wider functional field of vision. On a psychological level, Bertollo *et al.* (2022) associate success in foil with strategic patience and emotional control, while in sabre they highlight controlled aggression and impulse control.

In the Cuban context, authors such as Sánchez Córdova *et al.* (2020) have integrated proactivity and creative potential as key indicators for the selection of fencers. Lastres Madrigal *et al.* (2022) validated a tactical purpose model for combat sports, while Cordero Nápoles *et al.* (2011) proposed specific tests of reaction speed and translation. Ilisástigui Avilés (1999) and Ilisástigui and Fleitas (2001) introduced the methodology of contrasting real and ideal models, and Bodes Yanes (2001) demonstrated the viability of mathematical decision algorithms using his "method of balances."

Despite this valuable background, the literature lacks a study that systematically integrates findings on the differentiated demands of foil, épée, and sabre with the explicit objective of constructing performance models to serve as the basis for a specialized guidance system. This research aims to fill this gap, based on the hypothesis that the multidimensional characterization of the demand profiles for each weapon will allow for the establishment of solid scientific foundations to guide potentially talented fencers toward the discipline with the greatest affinity, thus optimizing talent management in Cuban high-performance fencing.

MATERIALS AND METHODS

Research design and approach

A descriptive study with a mixed-methods approach was conducted, combining qualitative and quantitative methods to characterize weapon performance models. The research was carried out between January and December 2025, adopting an exploratory sequential design that allowed for the integration of a documentary analysis of the regulations, a systematic literature review, and the triangulation of findings from different sources.

Information collection and analysis procedures

Documentary analysis was used as the main method, applied to two fundamental corpora: (1) the Technical Regulations of the International Fencing Federation (FIE, 2022, 2023), from which the regulatory provisions that determine the differentiated tactical logics of foil (t.77, t.83-88), épée (t.90-92) and sabre (t.96-105) were extracted; and (2) the scientific literature published between 2017 and 2025, identified by systematic search in PubMed, Scopus, SciELO and Redalyc databases, using the descriptors: "fencing talent identification", "foil performance profile", "épée physiological", "know technical-tactical demands analysis", "fencing talent selection," and their combinations.

For the systematization of the requirements for each weapon, the ten indicators proposed by Copello Janjaque for the analysis of combat sports were applied, previously used in the Cuban context by Lastres Madrigal *et al.* (2017). These indicators include: classification of actions, functional structure, energy cost, predominant type of perception, space and time restriction, real and total duration, time between presentations, density of loads, duration of the competition, and effectiveness criteria.

Unit of analysis and inclusion criteria

The unit of analysis consisted of the performance profiles of high-level fencers in the three disciplines, derived from original studies published in indexed journals. Research reporting quantitative or qualitative data on the physical, technical, tactical, psychological, or cognitive demands of foil, épée, or sabre was included, using samples of national or international-level athletes. Studies focused exclusively on non-competitive children or on disciplines other than Olympic fencing were excluded.

Analysis and synthesis procedure

The data extracted from documentary and bibliographic sources were organized into analysis matrices according to the dimensions established in Copello's indicators. A theoretical triangulation process was carried out, comparing the findings of different authors for each weapon and dimension. The resulting profiles were subjected to a validation process using

the consensus technique with three experts (two PhDs in sports science specializing in combat sports and a national fencing coach with more than 20 years of experience), who evaluated the relevance and comprehensiveness of the characterizations developed.

Limitations of the study

The main limitation of this research lies in its predominantly descriptive and theoretical nature, based on the systematization of previous findings rather than the collection of primary data on Cuban fencers. While the constructed profiles are based on robust international evidence, their applicability to the national context will require subsequent empirical studies to confirm the validity of the models within the Cuban population.

RESULTS AND DISCUSSION

Characterization of the competitive demands of the foil

Analysis of the regulations and specialized literature reveals that the foil is defined by three fundamental characteristics: priority convention (FIE, 2022, t.83-88), valid target area limited to the body (t.77), and exclusively tip actions (t.76). These provisions generate a tactical logic of controlling the initiative and achieving pinpoint precision.

The findings of Roi and Bianchedi (2022) indicate that elite foil fencers exhibit 35% higher accuracy rates than fencers of other weapons. This data is consistent with the biomechanical observations of Aquino *et al.* (2022), who report highly developed fine motor control patterns in this discipline. The requirement for accuracy on a reduced target is, therefore, a critical indicator for foil orientation.

In the cognitive domain, Piras *et al.* (2021) demonstrate that expert foil fencers process visual information 200 ms faster than novices, a crucial advantage for interpreting the weapons phrase and gaining priority. This finding is complemented by neuropsychological studies by

Bertollo *et al.* (2022), who associate success in foil with strategic patience and emotional control, profiles that allow for tolerating delays in tactical reward.

The application of Copello's indicators allows the systematization of the demands of the foil in the following way: varied acyclic actions, predominantly offensive and compound defensive; polyarticular functional structure with emphasis on kinematic chains of the lower body and weapon arm; energy cost in mixed zone (aerobic-anaerobic) with predominance of anaerobic processes that are determining for success; visual perception as the predominant type, complemented by kinesthetic, tactile and auditory; spatial restriction on a 14 m piste with periods of 3 minutes of effective time; variable duration according to the phrase of weapons; and effectiveness criterion based on conventionality, where attack prevails over defense.

Characterization of the competitive demands of the sword

The épée is distinguished by the absence of a priority convention (FIE, 2022, t.92) and the total valid surface area (t.91), which generates a tactical logic of calculated risk and speed of reaction. The analysis by Turner *et al.* (2023) reveals that 68% of touches in épée are counterattacks or responses, confirming the reactive nature of this discipline.

Chaabène *et al.* (2021) report that elite épée fencers have reaction times 15–20% faster than fencers of other weapons, a decisive advantage in a discipline where simultaneous touches are allowed. Additionally, Hassan *et al.* (2023) demonstrate that expert épée fencers possess a wider functional field of vision, an attribute necessary for processing information from the opponent's entire body.

The characterization using Copello's indicators for épée reveals: varied acyclic actions with a predominance of simple responses; a polyarticular functional structure similar to foil but with a greater demand for reaction speed; mixed energy cost where alactic anaerobic processes are determining factors; visual perception as the predominant type with emphasis on distributed attention; spatial and temporal restriction identical to foil; and effectiveness criterion based on the absence of convention, where the touch is direct and the double hit is valid.

On the psychological level, the findings of Bertollo *et al.* (2022) and Turner *et al.* (2023) converge in pointing out risk tolerance and probabilistic calculation as distinctive traits of the successful épée fencer, in contrast to the strategic patience of the foil fencer or the controlled aggressiveness of the sabre fencer.

Characterization of the competitive requirements of the saber

Sabre combines the priority convention (FIE, 2022, t.101-105) with the possibility of touching with the edge, back edge, and point (t.96), generating a tactical logic of speed, controlled aggression, and offensive continuity. The analysis by Hassan *et al.* (2023) indicates that 72% of actions in sabre are offensive, confirming the predominantly attacking nature of this discipline.

Bottoms *et al.* (2021) demonstrate that elite saber fencers exhibit greater lower limb power, an essential attribute for the explosive movements and arrow-like actions characteristic of this weapon. Biomechanical studies by Aquino *et al.* (2022) identify complex coordination patterns specific to the saber, particularly in the shoulder-elbow-wrist synchronization required for cutting actions.

The application of Copello's indicators to the saber reveals: varied acyclic actions with an offensive predominance; a polyarticular functional structure with emphasis on the lower body for explosive movements; mixed energy cost with a predominance of alactic anaerobic processes; visual perception as the predominant type, requiring high mobility of nervous processes and fast processing; a spatial restriction of 14 m with the particularity that time is not usually restrictive due to the dynamism of the actions; duration of very dynamic assaults (between 1.5 and 2 minutes of effective time in direct elimination); and a criterion of effectiveness based on conventionality with strict regulatory adjustment according to the phrase of weapons.

Psychologically, Bertollo *et al.* (2022) highlight controlled aggressiveness and impulsivity regulation as fundamental traits of the sabre player, a profile that allows maintaining constant initiative without engaging in non-priority actions (Table 1).

Table 1. – Comparative summary of requirements per weapon according to Copello indicators

Indicator	Foil	Sword	Saber
Stock classification	Combined offensive-defensive	Predominance of simple answers	Offensive dominance
Functional structure	Polyarticular, fine control	Multiarticular, reaction speed	Multiarticular, explosive power
Energy cost	Mixed (anaerobic determinant)	Mixed (alactic determinant)	Mixed (predominantly alactic)
Predominant perception	Visual + fine kinesthetic	Visual (distributed attention)	Visual (fast processing)
Effectiveness criterion	Convention (priority)	Without convention (direct hit)	Convention (offensive action)
Reaction time	Complex processing	15-20% faster	Execution speed
Precision	35% higher in reduced white	Wide precision	Dynamic precision
Psychological profile	Strategic patience	Risk calculation	Controlled Aggression

Source: own elaboration based on Roi & Bianchedi (2022), Chaabène et al. (2021), Bottoms et al. (2021), Piras et al. (2021), Bertollo et al. (2022), Turner et al. (2023), Hassan et al. (2023) and Aquino et al. (2022).

Integration of Cano Gutiérrez's creative indicators into weapon models

Cano Gutiérrez's (2018) research on creativity as a multidimensional phenomenon, with its 14 indicators, provides a novel perspective for differentiating profiles by weapon. In the context of fencing, these indicators manifest themselves differently:

- For foil, originality and fluency in weapon phrases, flexibility in adapting strategies, and sensitivity in reading the opponent's intentions emerge as key indicators. The strategic nature of this weapon demands divergent thinking capable of generating multiple tactical solutions.
- In fencing, initiative – understood as the ability to create opportunities, independence in decision-making under pressure, and the rationalization of risk/reward actions are crucial. The absence of convention fosters a more calculated and probabilistic approach.
- For saber, innovation in offensive sequences, fluidity in the continuity of actions, and the motivation to maintain high intensity emerge as key indicators. The speed of this

discipline demands creative but immediate responses, with less time for complex tactical planning.

These findings complement the previously described physical-technical profiles and reinforce the need for a multidimensional approach that considers both the conditional abilities and the cognitive styles and psychological dispositions of potential talents.

Implications for the design of a weapon guidance system

The results obtained provide a solid scientific basis for the development of a specialized guidance system. First, they confirm that there is no single profile of a talented fencer; what constitutes an advantage in one weapon may be irrelevant or disadvantageous in another. Second, they demonstrate the need for guidance assessments to be specific to each discipline: reduced-target accuracy tests under fatigue for foil, reaction time tests to multiple stimuli for épée, and assessments of explosive power and dynamic coordination for sabre.

Integrating the performance models developed here with the previous selection system of Lastres Madrigal (2023) would allow a shift from identifying "potentially talented fencers" to guiding them, based on sound reasoning, toward the discipline with the greatest affinity. This process would require the development of specific instruments that operationalize the identified discriminating indicators, as well as decision algorithms that compare the applicant's multidimensional profile with the reference models constructed for each weapon, following the model comparison methodology proposed by Ilisástigui Avilés (1999) and Ilisástegui and Fleitas (2001), and the variable weighting principles of the "Balances Method" by Bodes Yanes (2001).

CONCLUSIONS

Characterizing the competitive demands of foil, épée, and sabre using Copello's indicators and integrating findings from international and national literature allows for the establishment of clearly differentiated performance models for each weapon. Foil demands

absolute precision on a reduced target (35% higher than other weapons), complex visual processing (200 ms faster), and strategic patience. Épée requires extreme reaction speed (15-20% higher), an expanded functional field of vision, and a psychological profile focused on risk assessment, where 68% of touches are counterattacks. Sabre requires predominantly explosive power, complex segmental coordination for cutting actions, and controlled aggression, with 72% of actions being offensive in nature.

Fourteen creative indicators (Cano Gutiérrez, 2018) and ten functional indicators (Copello) were identified, which manifest themselves differently depending on the weapon, constituting a multidimensional system of discriminating criteria for guidance. These findings confirm the absence of a single profile of a talented fencer and scientifically justify the need to move from generalist selection models to integrated selection-guidance systems by discipline.

The constructed models address the research objective by providing the theoretical and methodological foundations for designing a guidance system that complements the previous selection system of Lastres Madrigal (2023). Comparing the applicant's multidimensional profile with the reference profiles established here, using evidence-based decision algorithms, would optimize the distribution of talent toward the weapon of greatest affinity, contributing to improving the quality of students transitioning to high-performance Cuban schools and, in the long term, enhancing the international competitive results of Cuban fencing.

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The authors declare no conflicts of interest.

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